



HARNESSING LIGHT-WEIGHTING TECHNOLOGY TO REDUCE VIBRATIONS IN HELICOPTER PANELS

CASE STUDY

QUIET INTERIOR PANELS FOR AIRCRAFT

Aircraft cabin quieting solutions for sandwich constructions used to construct lightweight interior panels tend to be unacceptably heavy and difficult to implement. Our Countervail® family of products are engineered to be extremely effective at reducing dynamic mobility to help reduce structure-borne noise levels of lightweight structures over a large (5- 2000Hz) frequency range.

The purpose of this brief case-study is to show how simply adding a few layers of Countervail® composite material to discrete areas of your existing design can deliver extreme levels of vibration reducing damping and help quiet structure-borne noise in lightweight aero-structures.

A TYPICAL DEVELOPMENT APPROACH

The high-energy input dynamic loadings for flight vehicles are well documented. To help guide the development effort, all cabin interior panels were removed from a BHTI 430 helicopter cabin and structural response and ambient noise levels were measured with the help of technical experts from the Center for Acoustics and Vibration at the Pennsylvania State University (CAV/PSU).

Data were taken during high-speed cruise transits, with and without its standard trim package to understand the input spectrum to the interior of the cabin.

Before presenting test and evaluation results, some background information on the mechanics of control of airborne sound will be provided. Clearly adding parasitic mass-loaded layers is not the most desirable solution for reducing noise transmission in weight critical aero-structures. The preferred alternative to mass treatments is the vibration canceling approach provided by our engineered material Countervail® - which adds stiffness and damping to control low- to mid-frequency structure borne noise without affecting the manufacturing process used for lightweight composite panels.

It is also important to consider that some panel structural vibration modes transmit sound more readily (efficiently) than others. These modes are said to have high radiation efficiency. Thus, it is often the primary goal of the noise control solution to reduce the admittance, or vibration amplitude, of panel modes that have high radiation efficiency. Using numerical simulation algorithms, the Countervail Products engineering team can conduct structural dynamics response analyses to determine optimal placement of Countervail® to reduce problematic vibration amplitudes and reduce structure borne noise.

PRODUCT IMPLEMENTATION

1. Armed with the performance data, the component manufacturer can move to the all-important technical and business case phase. For this particular application the technical improvement options afforded by adding Countervail® to the headliner panel could be stated as 1) reduce the weight from the baseline design while reducing interior noise at the primary nuisance frequencies 3-5dB, or 2) increase the mass slightly and provide a 5-10dB reduction.

The business case for a Countervail® solution is often settled by considering it is a true composite material solution; i.e., it has been engineered to be easily incorporated into laminated composite structures enabling component suppliers to deliver a product that out-performs competitors no changes in tooling and manufacturing procedures.

Please see our website www.countervailproducts.com for more information.

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